HEAPY

DESIGNING
DATA NETWORKS FOR
HIGH DEFINITION VIDEO STREAMING

REAL **COLLABORATION**
REAL **PERFORMANCE**
REAL **INSPIRATION**

WHAT DO YOU WANT FROM YOUR VIDEO STREAMING?

Video Streaming is at the top of everyone's mind. From setting up a personal Netflix subscription at home to replacing the coaxial cable TV distribution model in buildings, or even companies doing company-wide broadcast of announcements, video streaming can take multiple forms.

Video conferencing, using software packages such as Zoom or Microsoft Teams, are now an integral part of every day work. This makes a properly planned network not just nice to have, but essential to today's modernized technology-driven world.

There is not always an easy answer to the all-important question of what your video streaming needs should be. What resolution makes sense? Is it UHD? 1080p? 720p, and so on.

CAN MY NETWORK HANDLE THIS?

This is the next question once the level of service has been decided. It is not something that is often given too much thought, but how do you design your data network to account for the video needs of today and in the future?

Authored By

Michael Jankowski, PE, RCDD, CTS, Senior Technology Engineer

Before diving into this discussion, it is important to understand what the actual terms that define video streaming actually mean. There are multiple versions of “4K video”.

DIGITAL CINEMA INITIATIVES

First “4K” is actually “4K DCI” with the DCI standing for “Digital Cinema Initiatives”. This is a resolution of 4096 x 2160 with an aspect ratio of 21:9. Typically this is a format used by the film industry and this is the 4K video that you will see in cinema.

ULTRA HIGH DEFINITION

The more common version of “4K” that companies deal with in day to day life is actually “UHD,” or Ultra High Definition. UHD has a resolution of 3840 x 2160 pixels and a more familiar 16:9 aspect ratio and is typically what most people are referring to when they refer to “4K video.”

TRUE HD

The next most common video format is “True HD” or 1080p video. This is an extremely common video format in a 16:9 aspect ratio.

TERMS
TO UNDERSTAND

The three terms that are important to understand to fully answer what a video system should be capable of are the Frame Rate, Color Depth and Compression.

/ FRAME RATE

Frame Rate is relatively straightforward, how often should the image refresh in one second's time? This should be heavily based on what the output images will be, 30 frames per second is perfect for outputs such as PowerPoint, Excel spreadsheets or other various static images, but is less than ideal for content that has lots of motion, such as sports.

Selecting the higher frame rate has bandwidth implications that must be considered.

/ COLOR DEPTH

TRUE COLOR = **16 MILLION** COLORS / **DEEP** COLOR = **1+ BILLION** COLORS

Color Depth is the number of colors that an image can display. For example, True Color (24 Bit), which is extremely common, utilizes 8 bits for each of the Red, Green and Blue components of an image. This allows for just north of 16 million colors to be created. The next step up from there is Deep Color (30 bit), which utilizes 10 bits per component and ups the total number of colors to over 1 billion possibilities.

TERMS

TO UNDERSTAND CONTINUED

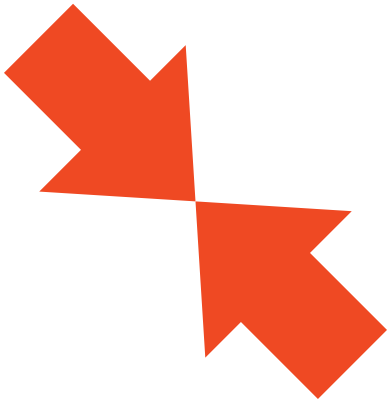
/COMPRESSION

Compression is taking information and removing data in a way that is either imperceptible or minimally perceptible to reduce the data requirements. In most cases this is done by sampling the information. In the case of audio, that means sampling the audio waveform at regular intervals so the gaps cannot be heard by the listener.

In the case of video, that means removing some of the video data, usually pixels or color information, and doing so in a way that the viewer will not be able to tell that the information has been removed. Despite the best efforts of compression algorithms, however, some information will always be lost in the process.

Chroma subsampling is an example of compression, it's hardly the only method and a relatively mild form of compression.

It should be noted, that what might be acceptable for viewing a PowerPoint or a training video would not be acceptable to art students or Doctors consulting where the actual color of something can have huge implications.



DATA RATES
OF VIDEO SIGNALS

So, knowing these items are important, what do they actually mean for data rates of video signals? The following chart gives a small sampling of video signals and what their data rates are, with Gbps standing for Gigabits per second.

Data Rate of Video Signals				
Resolution	Frame Rate	Chroma Subsampling (Compression)	8-Bit Color Data RAte	10-Bit Color Data Rate
1080p	60 fps	4:4:4	4.46 Gbps	5.57 Gbps
UHD	30 fps	4:4:4	8.91 Gbps	11.14 Gbps
UHD	60 fps	4:2:0	8.91 Gbps	11.14 Gbps
UHD	60 fps	4:4:4	17.82 Gbps	22.28 Gbps

The first thing that should stand out is the last line of this chart and the eye-watering data requirements for that video signal. UHD at 60 frames per second with no compression at all uses a tremendous amount of data. The 17.82 Gbps and 22.28 Gbps will cripple most data networks that are currently deployed, or even being deployed in the near future.

The next thing is the comparison between an uncompressed UHD signal at 30 fps and the compressed video signal at 60 fps. **THE BANDWIDTH REQUIREMENTS ARE EQUAL.**

Seeing all these scary bandwidth numbers is probably bringing up one question “But can I run Netflix in 4K at home and I don’t have a connection anywhere near that fast!” And this is absolutely true, however, there’s a reason for it, and that’s compression.

Using a compression algorithm known as VP9 (or H.264 in some situations), Netflix gets their 4K video requirements down to 25 Mbps, but it is important to keep in mind that this is an extremely aggressive compression. Also, important to remember is this is 25 Mbps per active connection! If every connection on a 48-port switch is streaming 4K at the same time this means that the switch uplink, also known as the network backbone link, will need to be capable of providing 1.2 Gbps of bandwidth.

As this scales across a network, those uplink numbers add up rather quickly and in the case of something such as a K-12 video distribution system where **EVERY CLASSROOM IS NOW STREAMING** instead of using the traditional distributed cable TV plant or a hospital with a **NETWORK BASED PATIENT EXPERIENCE SYSTEM** that bandwidth usage can quickly grow to the point that it **CAN CRIPPLE OTHER, ARGUABLY MORE ESSENTIAL, PLATFORMS.**

/VIDEO CONFERENCING

The other side to video distribution is video conferencing. While looking at platforms like Netflix and patient experience systems are important, they are also unidirectional, all information is being sent from a server directly to a client and is therefore relatively flexible with latency. Video conferencing, on the other hand, is not flexible with latency. Everyone has experience with that laggy video call where everyone ends up talking over each other because it is near impossible to tell when anyone is actually talking. While this will likely always be an issue to some degree, proper network planning can help mitigate it. Using Zoom as an example, a group video call in 1080p will require a connection of 2.5 mbps to receive HD video and 3.5 mbps to send HD video. Like with Netflix, this number alone does not sound overly scary, but also like Netflix, it is important to remember that this is per active connection.

Now that we have discussed all the various components of video streaming, what does this actually mean for network design? Well, there are **SEVERAL THINGS THAT SHOULD BE CONSIDERED:**

- How much network bandwidth is available either now or following planned upgrades?
- What is the primary use for the video that will be played on the network?
- What is the desired resolution for the video content?
- What level of compression is acceptable to the users?
- What refresh rate makes sense?
- Is a video network VLAN an option?

VIDEO STREAMING HAS BECOME A KEY PART OF OUR EVERYDAY LIVES and will likely only increase in usage as we move forward. While it is easy to try and simplify streaming down to just a few things that must be considered, or even just say “I want 4K!” no single video solution will suit every application. Being sure to “right size” your network to the video streaming solution you actually need is the best way to minimize headaches moving forward and balance the needs of the video system and the needs of the data / voice network.

For More Information Please Contact

Dwayne Henderson, RCDD
ICT Practice Director
dahenderson@heapy.com
937-272-0924

www.heapy.com

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